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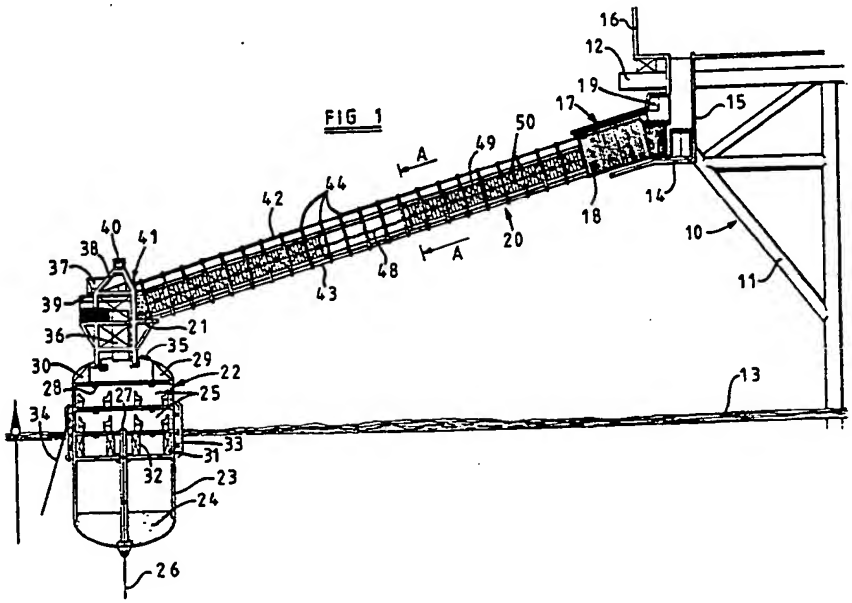
(54) Abandonment systems for structures surrounded by water

(57) An abandonment system, for use with a structure surrounded by water, such as an oil rig 10, comprises a safety station comprising a mono-tower or a buoy 22 which is permanently anchored in the water at a distance from the rig 10 and connected to the structure by a walkway 20. The buoy is equipped internally with emergency accommodation for crew members. Cables 42, 43 are permanently connected between the buoy 22 and a housing 17 on the oil rig. Cables 42, 43 normally hang freely but when it is required to evacuate the rig the cables are tensioned and the walkway, which is normally stored in the housing 17, is extended along the cables. The walkway comprises open frames 44 which are spaced along upper and lower inflatable tubes 46, 47 and the walkway is rapidly deployed along the cables 42, 43 by inflating the tubes from bottles of compressed air stored in the housing 17.

FIG 1



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.

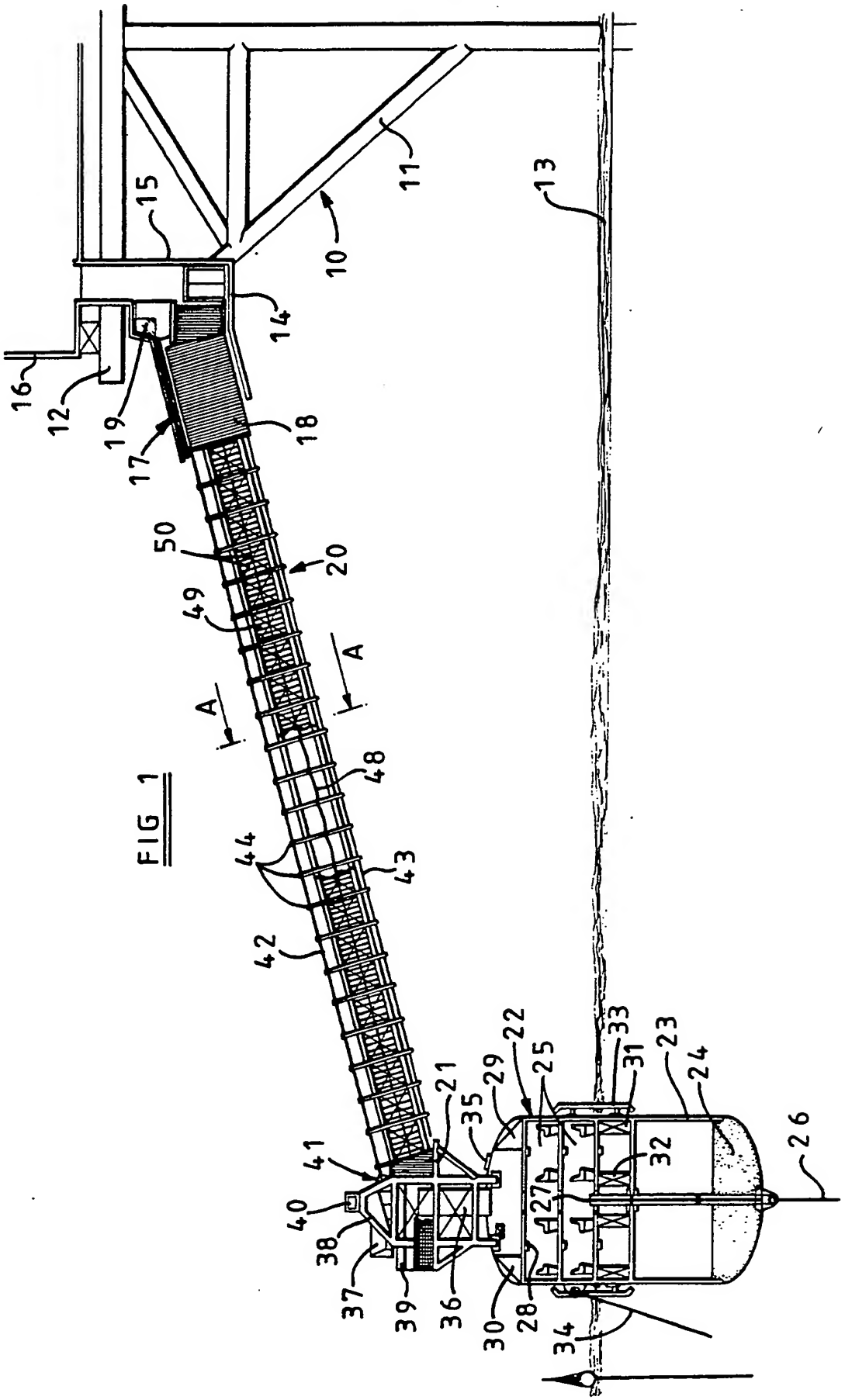
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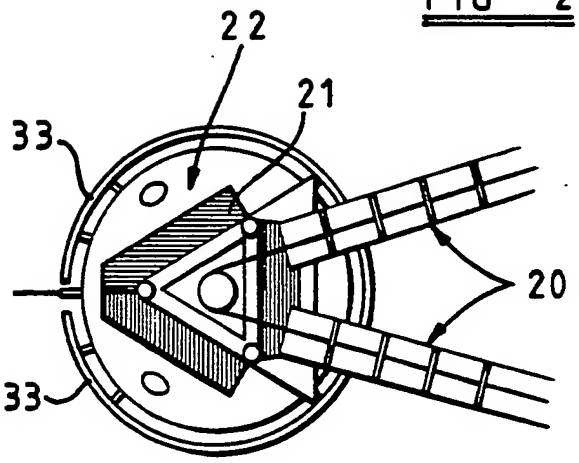
FIG 1

FIG 2



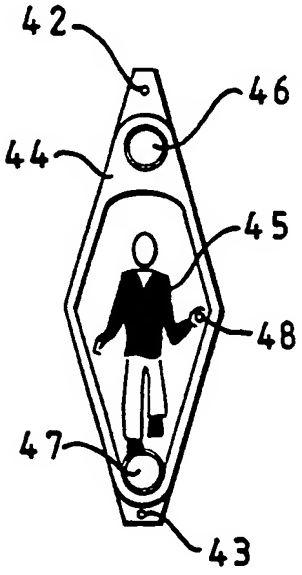


FIG 3

"Improvements in or relating to abandonment systems"

The invention relates to abandonment systems for use with structures which are surrounded by water. The system according to the invention is particularly suitable for use on oil platforms, but may be equally applicable to other structures which are erected at sea or in other large expanses of water.

Oil platforms usually carry large numbers of personnel and operate in an environment which can be hostile and dangerous. Although infrequent, serious accidents can occur which may cause fires, explosions, and/or partial or total collapse of the platform, and when such emergencies occur rapid evacuation of personnel from the platform is necessary. Conventionally, lifeboats have been provided for the purposes of such evacuation but these have severe disadvantages. Lifeboats normally require to be lowered a substantial distance from the platform, often into a very heavy sea, and it may be difficult to do this rapidly and efficiently in the chaotic conditions likely to prevail during an emergency. Furthermore, the lifeboat must then be brought clear of the platform, which may be in danger of collapse, and, even then, serious hazards still exist for those in the lifeboat in the heavy open sea or when attempts are made to pick them up by a larger rescue vessel.

In addition, when emergencies do occur on platforms, these may reach catastrophic proportions extremely rapidly and with little or no warning. There

may therefore be insufficient time to launch lifeboats, even if the conditions will allow such launch. There is therefore a requirement for a platform abandonment system which can be put into operation rapidly and which may allow the transfer of large numbers of personnel to safety without delay, and the present invention therefore sets out to provide such a system.

According to the invention, an abandonment system, for use with a structure surrounded by water, comprises a safety station which, in use, is substantially permanently disposed in the surrounding water at a distance from the structure, means securing the safety station in substantially a constant location, at least horizontally, with respect to the structure, and a transfer device for effecting the transfer of persons from the structure to the safety station, at least part of which transfer device is permanently connected between the structure and the safety station.

Since the safety station is permanently deployed and has at least part of the transfer device permanently connected to it, access to the safety station may be obtained very rapidly so that personnel may be moved to a location at a safe distance from the structure much more rapidly and easily than it would be possible to get a lifeboat launched from the platform and sailed to such a safe location.

The invention also includes within its scope a set of equipment for providing an abandonment system of

the kind referred, the equipment comprising a safety station, means for securing the safety station in water at a substantially constant location, and a transfer device for effecting transfer of persons from a structure to the safety station.

Although the safety station may comprise a structure, such as a mono-tower, mounted on the underwater bed, the safety station preferably floats at the surface of the water. For example, it may be in the form of a buoy anchored to the underwater surface, the retaining means comprising a suitable anchoring cable.

The safety station may be in the form of an enclosed capsule, containing one or more compartments to accommodate personnel, one or more access apertures being provided to permit entry and exit into and from the compartment or compartments. The capsule is preferably provided with a platform with which the aforesaid transfer means communicates, whereby persons transferred to the capsule are first received on the platform. For example, the platform may be located at the upper part of the capsule, an access shaft being provided whereby persons may move from the platform to the compartments within the capsule.

The safety station preferably includes life support and other equipment, such as an electrical generator, electric batteries, water tanks, oxygen supply, lighting, etc.

In the case where the safety station is

floating, means may be provided for detaching the transfer device and retaining means from the safety station, so that it may be floated to another location. Preferably the means for detaching the retaining means are operable from the station. Thus, where the retaining means is an anchoring cable connected to the underwater bed, the connection between the anchoring cable and the safety station may be located where it is accessible to persons on the safety station, i.e. from within the capsule when the station is in that form.

Preferably the transfer device comprises a flexible bridge assembly connected between the structure and the safety station. Persons being evacuated from the structure may then themselves walk or slide along the bridge assembly, this being the most rapid means of transferring large numbers of persons from the structure to the safety station.

Preferably the bridge assembly is flexible so as to accommodate comparatively small variations in the distance of the safety station from the structure in the case where the safety station is floating.

Although the whole bridge assembly may be permanently connected between the structure and the safety station, preferably only one or more guide elements are so permanently connected, the main part of the bridge assembly then being extended between the structure and the safety station, when required, using the guide elements. The main part of the bridge assembly is not then

susceptible to damage, for example from the weather, as would be the case if it were permanently in position.

The guide elements may comprise one or more cables, the main part of the bridge assembly being extended along said cable or cables when required. Preferably the permanently connected cables are normally hung under low tension, means being provided to increase the tension of the cables, when required, before extension of the main part of the bridge assembly along them. The main part of the bridge assembly may be suspended beneath at least one of said cables, when extended.

The main part of the bridge assembly may be longitudinally collapsible. For example, it may include one or more longitudinally collapsible inflatable conduits, extension of the main part being effected by inflating the conduit or conduits with air or other gas. Preferably the conduit or conduits are inflated by the supply of gas stored under compression in containers.

The main part of the bridge assembly may comprise a plurality of substantially rigid frame parts strung on said cable or cables, the frame parts being connected to said inflatable conduit or conduits at spaced intervals, whereby the frame parts may be stacked substantially adjacent one another when stowed, but are slid along said cable or cables in spaced succession as the conduit or conduits are inflated.

Preferably the frame parts are also connected by other longitudinally collapsible elements. Such elements

may comprise portions of a flexible hand rail, and/or fabric panels so that the bridge assembly is at least partly enclosed. The portion of the hand rail and/or fabric panels between adjacent frame parts may comprise sections of a single long flexible hand rail and/or fabric panel which extends longitudinally of the bridge assembly and to which a plurality of adjacent frame parts are connected.

Each frame part may provide a central aperture through which a person may pass, and in this case fabric panels may be provided joining all sides of adjacent frame parts so as to provide a substantially enclosed passageway along the length of the bridge assembly.

The aforementioned inflatable conduit, or one of said conduits, may be located in the lower part of the bridge assembly so as to provide a walkway for persons passing along the bridge assembly.

The following is a more detailed description of an embodiment of the invention, reference being made to the accompanying drawings in which:

Figure 1 is a diagrammatic side elevation, partly in section, of an abandonment system according to the invention,

Figure 2 is a plan view of the safety station capsule, and

Figure 3 is a section, on an enlarged scale, along the line A-A of Figure 1 showing the interior of the gangway.

Figure 1 is a diagrammatic side elevation of an abandonment system in accordance with the invention, as applied to an oil platform. The platform, generally indicated at 10 comprises a support structure 11 and a main deck 12. The support structure extends below the surface of the sea, indicated at 13, and is anchored to the sea bed. Most oil platforms are permanently anchored to the sea bed, but in some cases platforms are semi-submersible and may, from time to time, be detached from the sea bed and floated to another location.

Mounted beneath the main deck 12 of the platform is an escape platform 14, a fireproof shaft 15 extending downwardly from living quarters 16 on the main deck 12 to the escape platform 14. A ladder or staircase (not shown) extends down the shaft 15.

Mounted on the escape platform 14 is a housing 17 for an extensible gangway which, in its unextended or collapsed condition, is received within the housing 17 as indicated diagrammatically at 18. A control room 19 on the platform 14 controls operation of the extensible gangway, in a manner to be described.

The gangway provides the aforementioned bridge assembly and, in its extended condition as indicated at 20 in Figure 1, connects the escape platform 14 to a safety platform 21 mounted on the upper part of a safety station in the form of a buoy 22. The buoy 22 comprises a hollow, generally cylindrical, steel capsule 23 having domed upper and lower ends. The lower part of the capsule is filled

with free flooding compartments and solid ballast as indicated at 24, and the upper part of the capsule is divided into compartments 25 to receive escaping members of the platform,s crew.

The buoy 22 is anchored to the sea bed by means of a conventional steel anchorage cable 26. The upper end of the anchoring cable is connected to a release mechanism 27 accessible from the lowermost of the compartments 25 in the capsule.

The compartments 25 are equipped with seats, with safety belts, to accommodate crew members. Lighting 28 is provided in the compartments and heating may also be provided. There are also provided in the compartments emergency radio communications, EPIRB, and power and hand bilge pumps. A generator 29 and a supply of diesel oil is housed in the domed upper part of the buoy 22, as are also fresh water tanks 30. Beneath the crew compartments is a further compartment housing batteries 31 and an oxygen supply 32. An air duct 37 leads downwardly from the platform 21 to the interior of the capsule 23 to provide a supply of fresh air to the crew compartments.

Since the weight of the buoy is not critical it is possible to provide a much higher level of survival enhancement equipment than is possible in a lifeboat, in particular medical facilities for injury and hypothermia. Although the air duct 37 provides natural ventilation, in a gas laden atmosphere this would be closed down and breathing supplemented either by bottled air (for short

durations) or by carbon dioxide removal and oxygen top up as is usual, for example, in submarines. Capsule drenching systems to maintain acceptable internal temperatures in the case of fire could also be installed.

Fenders 33 are provided around the periphery of the buoy, across the water line, and a towing cable 34 is connected to the outside of the buoy 22.

Access into the interior of the upper domed portion of the capsule is provided by a manhole 35, but otherwise access to the interior of the capsule, and to the compartments 25, is through a vertical access shaft 36 which leads upwardly from the upper end of the capsule and on to the platform 21, an access ladder being provided along the shaft 36. A lattice mast 38 on the platform 21 supports guard rails 39 and a strobe light and beacon 40. Apparatus 41 is also mounted on this structure for effecting release of the end of the gangway 20 from the platform 21 when required.

The construction of the gangway 20 will now be described.

The gangway comprises vertically spaced upper and lower cables 42 and 43 permanently connected between the housing 17 on the oil platform and the lattice mast 38 on the buoy 22. The uppermost wire 42 is the primary support for the gangway, the lower wire 43 being mainly to prevent twisting. The cables are normally under low tension and hang freely between the structure and the buoy so as to permit a certain amount of comparatively small

relative movement between the buoy and the platform. Before deploying the gangway, the cables are tensioned to render them as taut as possible and they are then maintained under constant tension. This may be achieved by using a clump-weight and multiple block system, accumulator etc., in the housing 17.

Strung along the cables 42 and 43 are a plurality of generally diamond-shaped open frames 44, which may be formed from aluminium, fibre reinforced plastics or other strong, lightweight, generally rigid material. The central aperture in each frame is large enough for a man to pass through as indicated at 45 in Figure 3.

The frames are spaced at equal intervals along upper and lower inflatable tubes 46 47, formed for example of rubberised or plasticised fabric. The upper tube 46 passes through circular holes in the frames 44 while the lower tube sits in the curved bottom parts of the apertures in the frames so that the upper surface of the lower tube 47 provides a walkway.

A rope handrail 48 extends along the gangway between adjacent frames. Adjacent frames are also connected by panels of fabric 49 which may for example be fireproof canvas sold under the trade name "Bestobell". Diagonal wires 50 also connect adjacent frames 44.

Normally the tubes 46 and 47 are uninflated and the whole assembly of frames 44, tubes 46, 47, side panels 49, wires 50, and handrail 48 are collapsed together,

concertina-fashion, to a position where they are accommodated within the housing 17. Bottles of compressed air are connected to the ends of the tubes 46 and 47.

When it is required to deploy the abandonment system the cables 42 and 43 are tensioned, as previously described, and the valves of the air bottles are then opened to inflate the tubes 46 and 47. This causes the tubes to expand longitudinally, shooting the frames 44 along the cables 42 and 43 to the extended position of the gangway shown at 20 in Figure 1. The diagonal wires 50 serve to brace the extended assembly and the assembly may be further tensioned by applying tension at the platform 21.

The gangway may thus be deployed very rapidly and, once in position, personnel from the platform may descend to the platform 14 through the shaft 15 and then pass rapidly along the gangway to the buoy 22. As shown in the plan view of the buoy in Figure 2, there may be provided two gangways 20 extending from different parts of the oil platform to increase further the rate at which personnel may be evacuated.

In the case where the oil platform is evacuated in view of potential danger, personnel may simply remain in the capsule 23 until the risk of danger has passed, and may then return to the platform. They may return along the gangways 20 or, if conditions are appropriate, it may be more convenient to return them to the platform by boat.

However, if a serious emergency occurs requiring

essentially permanent evacuation of the platform, the buoy may be removed from the vicinity of the platform. In order to effect this the cables 42 and 43 are detached from the lattice mast 38 so that each gangway falls away. The buoy is then detached from the anchoring cable 26 by actuating the release mechanism 27 from within the capsule. If a relief vessel is not available, such release of the buoy should of course only be effected when the prevailing conditions will carry the buoy away from the platform. If a relief vessel is available it may take the buoy in tow using the tow line 34.

The capsule would normally be located in such a position in relation to the oil platform that, under the influence of predominant wind and current, it would naturally drift clear when released. However, if conditions are such, during an emergency, that the capsule if disconnected would drift towards the platform, it follows that the capsule is in any case upwind of the platform and will not normally therefore be at risk from fire aboard the platform. The capsule may therefore remain connected until a relief vessel is available.

Conveniently, the housing 17 may be in the form of a removable container module which can be removed from the platform, together with the gangway stowed inside, for annual servicing ashore, a replacement being fitted. Also the container can be removed for repacking the gangway ashore after the system has been deployed.

CLAIMS

1. An abandonment system, for use with a structure surrounded by water, comprising a safety station which, in use, is substantially permanently disposed in the surrounding water at a distance from the structure, means securing the safety station in substantially a constant location, at least horizontally, with respect to the structure, and a transfer device for effecting the transfer of persons from the structure to the safety station, at least part of which transfer device is permanently connected between the structure and the safety station.

2. A system according to Claim 1, wherein the safety station comprises a structure mounted on the underwater bed.

3. A system according to Claim 1, wherein the safety station is in the form of a buoy anchored to the underwater surface, the retaining means comprising a suitable anchoring cable.

4. A system according to any of Claims 1 to 3, wherein the safety station is in the form of an enclosed capsule, containing one or more compartments to accommodate personnel, one or more access apertures being provided to permit entry and exit into and from the compartment or compartments.

5. A system according to Claim 4, wherein the capsule is provided with a platform with which the aforesaid transfer means communicates, whereby persons

transferred to the capsule are first received on the platform.

6. A system according to Claim 5, wherein the platform is located at the upper part of the capsule, an access shaft being provided whereby persons may move from the platform to the compartments within the capsule.

7. A system according to any of Claims 1 to 6, wherein the safety station includes life support and other equipment selected from an electrical generator, electric batteries, water tanks, oxygen supply, lighting etc.

8. A system according to any of Claims 1 to 7, and in which the safety station is a floating buoy, wherein means are provided for detaching the transfer device and retaining means from the buoy, so that it may be floated to another location.

9. A system according to Claim 8, wherein the means for detaching the retaining means are operable from the buoy.

10. A system according to any of Claims 1 to 9, wherein the transfer device comprises a flexible bridge assembly connected between the structure and the safety station.

11. A system according to Claim 10, wherein the bridge assembly is flexible so as to accommodate comparatively small variations in the distance of the safety station from the structure in the case where the safety station is floating.

12. A system according to Claim 10 or Claim 1,,

wherein one or more guide elements are permanently connected between the structure and the safety station, the main part of the bridge assembly then being extended between the structure and the safety station, when required, using the guide elements.

13. A system according to Claim 12, wherein the guide elements comprise one or more cables, the main part of the bridge assembly being extended along said cable or cables when required.

14. A system according to Claim 13, wherein the permanently connected cables are normally hung under low tension, means being provided to increase the tension of the cables, when required, before extension of the main part of the bridge assembly along them.

15. A system according to any of Claims 12 to 14, wherein the main part of the bridge assembly is longitudinally collapsible.

16. A system according to Claim 15, wherein the main part of the bridge assembly includes one or more longitudinally collapsible inflatable conduits, extension of the main part being effected by inflating the conduit or conduits with air or other gas.

17. A system according to Claim 16, wherein the main part of the bridge assembly comprises a plurality of substantially rigid frame parts strung on said cable or cables, the frame parts being connected to said inflatable conduit or conduits at spaced intervals, whereby the frame parts may be stacked substantially adjacent one another

when stowed, but are slid along said cable or cables in spaced succession as the conduit or conduits are inflated.

18. A system according to Claim 17, wherein the frame parts are also connected by other longitudinally collapsible elements comprising portions of a flexible hand rail, and/or fabric panels so that the bridge assembly is at least partly enclosed.

19. A system according to Claim 17 or Claim 18, wherein each frame part provides a central aperture through which a person may pass, fabric panels being provided joining sides of adjacent frame parts so as to provide a partly or wholly enclosed passageway along the length of the bridge assembly.

20. A system according to any of Claims 16 to 19 wherein the inflatable conduit, or one of said conduits, is located in the lower part of the bridge assembly so as to provide a walkway for persons passing along the bridge assembly.

21. An abandonment system substantially as hereinbefore described with reference to the accompanying drawings.